U. S. DEPARTMENT OF COMMERCE
JESSE H. JONES, Secretary
NATIONAL BUREAU OF STANDARDS
LYMAN J. BRIGGS, Director

PLYWOOD

(Hardwood and Eastern Red Cedar)

(SECOND EDITION)

COMMERCIAL STANDARD CS35–42

[Supersedes CS35–31]

Effective Date for New Production From July 15, 1942

A RECORDED VOLUNTARY STANDARD
OF THE TRADE

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U. S. DEPARTMENT OF COMMERCE NATIONAL BUREAU OF STANDARD

PROMULGATION

of

COMMERCIAL STANDARD CS35–42

for

PLYWOOD

(Hardwood and Eastern Red Cedar)

(Second Edition)

On April 9, 1931, at the instance of the Plywood Manufacturers Association, a general conference of representative manufacturers distributors, and users of Plywood (Hardwood and Eastern Red Cedar) adopted a recommended commercial standard for this commodity which was subsequently accepted in writing by the trade and published as Commercial Standard CS35–31.

On May 1, 1942, with the approval of the Standing Committee, a revision of CS35–31, drafted by the Hardwood Plywood Institute, was circulated for acceptance. Those concerned have since accepted and approved the revised standard as shown herein for promulgation by the United States Department of Commerce, through the National Bureau of Standards.

The standard is effective for new production from July 15, 1942.

Promulgation recommended.

I. J. Fairchild,
Chief, Division of Trade Standards

Promulgated.

Lyman J. Briggs,
Director, National Bureau of Standards

Promulgation approved.

Jesse H. Jones,
Secretary of Commerce

PLYWOOD

(Hardwood and Eastern Red Cedar)

(Second Edition)

COMMERCIAL STANDARD CS35-42

PURPOSE

1. These commercial standard grading rules are established as a universal basis of common understanding in the hardwood plywood industry. By their general adoption and use, much of the confusion hitherto experienced between buyer and seller will be eliminated. Designers, architects, and purchasing agents will be able to specify their needs from nationally recognized grades. The general satisfaction and ease of procurement made possible by nationally recognized grades should have a very beneficial effect on the entire industry.

SCOPE

2. This standard provides minimum specifications for four standard grades of hardwood plywood made with three different types of bondage having a high, moderate, and low resistance to moisture. It covers tests, standard thicknesses, widths, and lengths, tolerances, workmanship, packing, inspection, and nomenclature and definitions.

GENERAL REQUIREMENTS

3. *Workmanship.*—All plywood sold as of commercial standard quality shall be well manufactured and free from blisters, wrinkles, laps, or other defects, except as permitted in the specific rules for the various grades.

4. *Packing.*—All commercial standard plywood shall be securely packed to insure delivery in a clean and serviceable condition.

5. *Inspection.*—All hardwood plywood guaranteed to conform to the commercial standard grading rules is sold subject to inspection in the white only, and complaints regarding the quality of any shipment must be made within 15 days from receipt thereof.

DETAIL REQUIREMENTS

6. *Adhesives.*—The gluing of plywood is an art requiring meticulous care and precision to insure a satisfactory product, and therefore all commercial standard plywood shall be bonded in an approved manner with material best adapted to each use classification. Since the use to which the plywood is to be put determines the type of bond necessary, adhesives have been graded according to the characteristics of their bonds.

6a. *Type 1 (high moisture resistance).*—The bonds shall be highly resistant to all types of severe exposure involving water and dampness. The joints shall be highly resistant to attack by microorganisms and

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shall show high strength and wood failure, when tested to destruction, after repeated exposures to wetting and drying cycles.[1]

6b. *Type 2 (moderate moisture resistance).*—The bonds shall be resistant to water and dampness. The joints shall be of such quality that specimens will withstand the test as prescribed in paragraph 93.

6c. *Type 3 (low moisture resistance).*—Joints shall show high strength and wood failure when tested to destruction in the dry condition, but water resistance shall not be required of this type.

7. Paragraphs 11 to 80, inclusive, present the quality requirements for the various grades of faces and backs for commercial standard plywood.

8. Cores and crossbandings for commercial standard plywood shall be made in an approved manner of any suitable wood. Where specially designated cores or crossbandings are required, the grade rules covered by paragraphs 81 to 90, inclusive, shall be used. Plywood construction is illustrated in figure 1.

9. The grade of the surfaces is usually designated according to the use to which the plywood is put, and a panel designated "AA" would be one in which both surfaces were of "A" grade. In the use of plywood panels for desk tops and similar purposes, the quality of the unexposed side is of lesser importance and may be designated in one of the two general grades for backs described below.

10. The proper interpretation of the rules for any specific grade also necessitates full consideration of the next higher or lower grades of the same species, since these tend to clarify the requirements with minimum repetition.

BACKS

11. *No 2 or sound backs.*—Those of any species of wood, unselected for uniformity of color, not matched for color or grain. Hair-line open joints, sap, stains, burls, sound pin knots, and patches shall be admitted. Machine sanding or removal of tape required.

12. *No. 3 or reject backs.*—Those of any species of wood. Doze, stain, pithy knots, discolorations, burls, loose-cutting, checks, splits, open knots, and open joints shall be admitted. Sanding or removal of tape is not required.

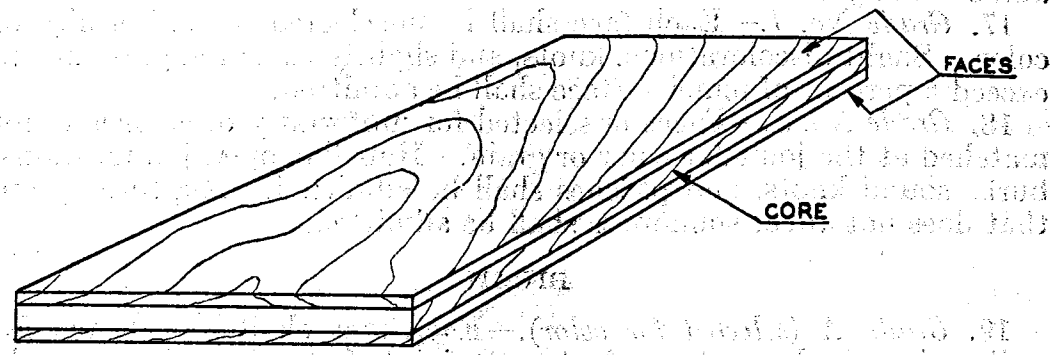
ASH AND ELM

13. *Grade No. 1.*—Each face shall be unselected for uniformity of color but must be matched for color and grain at the joints. Sap, small burls, one or two small mineral streaks, and inconspicuous patches shall be admitted. Knots and wormholes shall not be admitted.

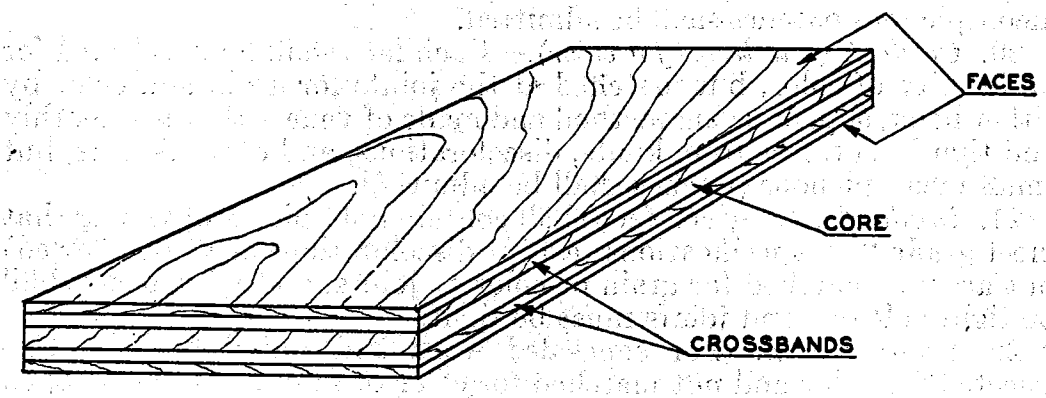
14. *Grade No. 2.*—Faces not matched for color or grain. Hair-line open joints, sap, discolorations, glue stains, burls, sound pin knots, pin wormholes, loose-cutting, and patches shall be admitted. Splits, checks, and similar open defects, if inconspicuously filled or patched, shall be admitted.

15. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

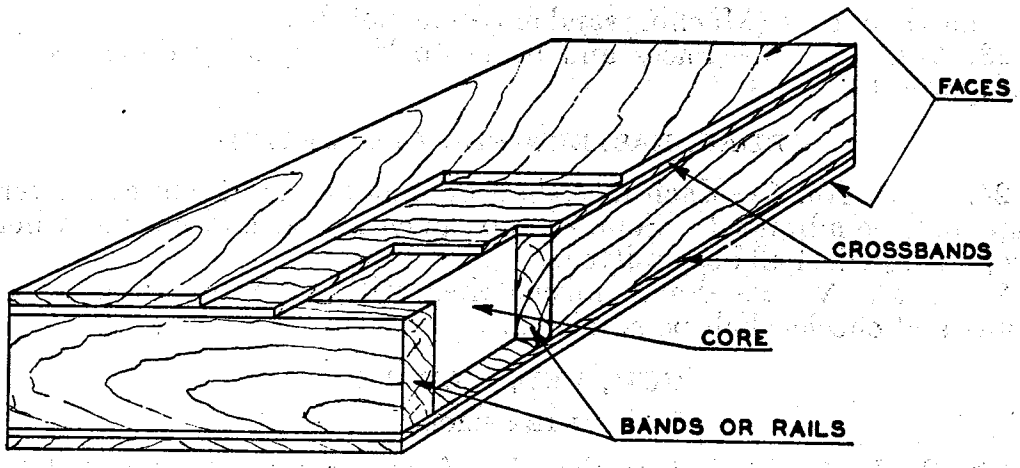
[1] Tests as covered by paragraph 92 are for standard commercial plywood. Plywood is manufactured that will stand more rigid tests, but must be manufactured to specific specifications and using special thickness veneers, adhesives, and other special construction, such as elimination of all paper tape from the interior plies.



THREE-PLY CONSTRUCTION WITH VENEER CORE.



FIVE-PLY CONSTRUCTION WITH VENEER CORE.



FIVE-PLY CONSTRUCTION WITH SAWN LUMBER CORE AND BANDING OR RAILING.

FIGURE 1.—*Plywood construction.*

BASSWOOD

16. *Grade A.*—Each face shall be selected for uniform light color, matched at joints for grain, and made of veneer that shall be tight and smoothly cut. Knots and stains shall not be admitted.

17. *Grade No. 1.*—Each face shall be unselected for uniformity of color. Slight discolorations, knots, and slightly ruptured grain not to exceed 5 percent of panel surface shall be admitted.

18. *Grade No. 2.*—Faces unselected for uniformity of color and not matched at the joint for color or grain. Hair-line open joints, stains, burls, sound knots, and patches shall be admitted. Ruptured grain that does not affect soundness shall be admitted.

BIRCH

19. *Grade A (selected for color).*—Each face shall be selected for uniformity of color and matched at the joints for grain by either book, slip, or swing method and made of veneer that is smoothly and tightly cut, free from knots, discolorations, and other defects, but small inconspicuous patches shall be admitted.

20. *Grade A (unselected for color).*—Each face shall be unselected for uniformity of color, but matched at the joints for grain and color by either book, slip, or swing method and made of veneer that is smoothly and tightly cut, free from knots, discolorations, and other defects, but small inconspicuous patches shall be admitted.

21. *Grade No. 1.*—Each face shall contain only pieces of veneer that meet grade "A" specifications (except discolorations shall be allowed) but are not matched for grain or color at joints, and all veneers shall be tight side out and joints must be tight.

22. *Grade No. 2.* (For concealed work and sound backs).—Unselected for color and not matched for color or grain. Hair-line open joints, discolorations, burls, sound knots, ruptured grain, and any amount of sound patches admitted. This grade is not suitable for enamel or good paint finishes. This grade in plywood requires sanding or removal of tape (Machine sand only—no polish).

23. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

CEDAR, EASTERN RED (AROMATIC)

24. *Grade No. 1.*—Each face shall be matched for grain character. Sap shall be admitted. Sound knots, open knots, and checks, when properly filled, shall be admitted.

25. *Grade No. 2.*—Faces mismatched with unlimited number of knots and checks shall be admitted.

GUM, RED, FIGURED

QUARTER SLICED

26. *Grade A.*—Each face shall be of veneer carefully selected for well-balanced and decorative figure and properly matched. A few small inconspicuous knots and a small amount of sap that increases the decorative figure shall be admitted, but no discolorations shall be admitted.

27. *Grade No. 1.*—Each face shall be of veneer matched for well-balanced and decorative figure. A few small inconspicuous knots and sap shall be admitted, but no discolorations shall be admitted.

28. *Grade No. 2.*—No figure or matching requirements. Small sound knots, sap, and discolorations shall be admitted.

29. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

GUM, RED

SAWN, SLICED, OR ROTARY CUT

30. *Grade A.*—Each face shall be of one or more pieces of veneer of random widths with the tight side exposed and matched to show uniform color throughout; occasional pin knots admitted. Discolorations shall not be admitted. Wormholes, if inconspicuously filled or patched, shall be admitted.

31. *Grade No. 1.*—Each face shall be of one or more pieces of veneer of random widths with the tight side exposed and matched to show uniform color throughout. Sound pin knots, not to exceed an average of two for each square foot, and slight discolorations shall be admitted. Small inconspicuous patches shall be admitted.

32. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

GUM [2], POPLAR, SYCAMORE

ROTARY CUT

33. *Grade A.*—Each face shall be of one or more pieces of veneer of random widths with the tight side exposed and reasonably well matched for color at joints. Knots and discolorations shall not be admitted.

34. *Grade No. 1.*—Each face shall be of one or more pieces of veneer of random widths with the tight side exposed and not matched for color and grain at joints. Sound pin knots, not to exceed an average of two for each square foot, and slight discolorations shall be admitted. Small inconspicuous patches shall be admitted.

35. *Grade No. 2.*—No character, color, grain, or texture requirements. Pin knots, splits, checks, and similar open defects, if inconspicuously filled or patched, shall be admitted.

36. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

MAHOGANY

37. *Grade A.*—Each face shall be matched for figure in either ribbon stripe, plain stripe, broken stripe, or flat cut, as may be designated. Streaks, discolorations, pin knots, cross breaks, and sap shall not be admitted.

38. *Grade No. 1.*—Each face shall be matched for figure. Pin knots, not in excess of two for each square foot of panel, shall be admitted. Sap, streaks, cross breaks, and discolorations shall not be admitted. Wormholes, if inconspicuously filled or patched, shall be admitted.

39. *Grade No. 2.*—No requirements for figure or matching. Streaks, discolorations, pin knots, wormholes, and cross breaks shall be admitted. Splits, checks, and similar open defects, if filled or patched, shall be admitted.

40. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

[2] This classification includes unselected sap gum (the sapwood of the red- or sweet-gum tree), together with the species known as black gum, or tupelo.

MAPLE

41. *Grade A (selected white for color).*—Each face shall be made of tight and smoothly cut veneer sapwood selected for uniformity of color and matched at the joints for grain. Mineral streaks not to exceed 1/16 inch in width by 1 inch in length shall be admitted if not in excess of one to each 3 square feet of panel surface. Bird's-eye figure, knots, discolorations, and other defects shall not be admitted.

42. *Grade A (unselected for color).*—Each face shall be made of veneer unselected for color, tight and smoothly cut, selected for uniformity of color and matched at the joints for grain. Mineral streaks not to exceed 1/8 inch in width by 1 inch in length shall be admitted if not in excess of one to each square foot of the panel surface. Bird's-eye figure, burls, swirls, and inconspicuous patches shall be admitted.

43. *Grade No. 1.*—Each face shall be made of veneer unselected for color or grain and not matched at the joints for color or grain. Stains, mineral discolorations, burls, bird's-eyes, and small sound knots shall be admitted. Hair-line open joints shall not be admitted. Joints to be glued.

44. *Grade No. 2.*—Each face shall be made of veneer unselected for color or grain and not matched at the joints for color or grain. Hair-line open joints, stains, mineral discolorations, burls, bird's-eyes, and small sound knots shall be admitted.

45. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

OAK, WHITE AND RED

KNIFE CUT

46. *Grade A.*—Each face shall be matched for uniform grain and color. Discolorations, sap, knots, and wormholes shall not be admitted. Small burls, and a few small mineral streaks shall be admitted.

47. *Grade No. 1.*—Each face shall be matched for color but not for grain. Slight mineral streaks, slight glue stains, burls, sound pin knots, and inconspicuous patches shall be admitted. Sap and wormholes shall not be admitted.

48. *Grade No. 2.*—Faces not matched for color or grain. Hair-line open joints, sap discolorations, glue stains, burls, sound pin knots, pin wormholes, loose-cutting, and patches shall be admitted. Splits, checks, and similar open defects, if inconspicuously filled or patched, shall be admitted.

49. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

SAWN, QUARTERED, COMB GRAIN

50. *Grade A.*—Each face shall be of veneer matched for select figure (either large or small figure if so designated). A few mineral streaks shall be admitted. Sap, knots, discolorations, broken flake, and wormholes shall not be admitted.

51. *Grade No. 1.*—Each face shall be of veneer matched at the joint for color and figure but otherwise unselected for figure or color. Sound pin knots, streaks, and discolorations, not exceeding an average of two for each square foot, shall be admitted. Bright sap shall be admitted.

52. *Grade No. 2.*—Face veneers unselected for figure or color. Mismatches, sap, streaks, discolorations, small sound knots, broken flake, and hair-line open joints shall be admitted. Splits, checks, and similar open defects, if filled or patched, shall be admitted.

53. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

WALNUT

ROTARY CUT[3]

54. *Grade A.*—Each face shall be of one or more pieces of veneer of random widths. It shall be of uniform grain and matched for grain character and color. A few small inconspicuous pin knots shall be admitted. Streaks, discolorations, sap, and wormholes shall not be admitted.

55. *Grade No. 1.*—Each face shall be of one or more pieces of veneer of random widths. It shall be matched for grain character at joints. Sound pin knots shall be admitted if the average is not in excess of two for each square foot. Mineral discolorations shall be admitted. Bright sap, not to exceed 10 percent, and wormholes, if inconspicuously filled or patched, shall be admitted.

56. *Grade No. 2.*—Faces of veneer unselected for grain character or color and composed of one or more pieces of random widths. Mismatches, discolorations, and small sound knots shall be admitted. Bright sap, not to exceed 25 percent, and wormholes, if inconspicuously filled or patched, shall be admitted.

57. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

ROTARY CUT—SAP GRADES

58. *Grade No. 1.*—Each face shall be of one or more pieces of veneer of random widths. It shall be matched for grain character at the joints. Sound pin knots shall be admitted if the average is not in excess of two for each square foot. Sap or black wood, in unlimited quantities, and mineral discolorations, shall be admitted. Wormholes, if inconspicuously filled or patched, shall be admitted.

59. *Grade No. 2.*—Each face shall be of one or more pieces of veneer of random widths, unselected for grain character or color. Mismatches, discolorations, small sound knots, and sap or black wood, in unlimited quantities, shall be admitted. Wormholes, if filled or patched, shall be admitted.

60. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

HALF ROUND[4]

61. *Grade A.*—Each face shall be of one or more pieces of veneer of random widths and matched for uniform color. Twenty-five percent, either heart- or stripe-grain character, is required. A few small inconspicuous pin knots shall be admitted. Streaks, discolorations, sap, and wormholes shall not be admitted.

62. *Grade No. 1.*—Each face shall be of one or more pieces of veneer of randum widths and matched for uniform color. Striped- or heart-grain character admitted in any proportions. Sound pin knots ad-

[3] Veneer showing full rotary cut and a wide variety of grain character.
[4] A veneer produced on a rotary machine by off-center cutting. This results in a larger percentage of stripe character than by full rotary cutting.

mitted if the average is not in excess of two per square foot. Mineral discolorations shall be admitted. Bright sap, not to exceed 10 percent, and wormholes, if inconspicuously filled or patched, shall be admitted.

63. *Grade No. 2.*—Each face shall be of one or more pieces of veneer of random widths, unselected for grain character or color. Mismatches, discolorations, and sound pin knots shall be admitted. Bright sap, not to exceed 25 percent, and wormholes, if filled or patched, shall be admitted.

64. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

HALF ROUND—SAP GRADES

65. *Grade No. 1.*—Each face shall be of one or more pieces of veneer of random widths. Striped- or heart-grain character admitted in any proportions. Sound pin knots are permitted if the average is not in excess of two per square foot. Mineral discolorations shall be admitted. Sap or black wood, in unlimited quantities, shall be admitted. Wormholes, if inconspicuously filled or patched, shall be admitted.

66. *Grade No. 2.*—Each face shall be of one or more pieces of veneer of random widths, unselected for grain character or color. Mismatches, discolorations, and sound pin knots shall be admitted. Sap or black wood, in unlimited quantities shall be admitted. Wormholes, if filled or patched, shall be admitted.

67. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

SLICED [5]

68. *Grade A.*—Each face shall be of one or more pieces of veneer of random widths and matched for uniform color and grain character. Sixty percent of heart-grain character is permitted. A few small inconspicuous pin knots shall be admitted. Streaks, discolorations, sap, and wormholes shall not be admitted.

69. *Grade No. 1.*—Each face shall be of one or more pieces of veneer of random widths. Eighty-five percent heart-grain character is permitted. Mineral discolorations shall be admitted. Sound pin knots are permitted if the average is not in excess of two for each square foot. Bright sap, not to exceed 10 percent, and wormholes, if inconspicuously filled or patched, shall be admitted.

70. *Grade No. 2.*—Each face shall be of one or more pieces of veneer of random widths, unselected for grain character or color, and with striped or heart grain in any proportion. Mismatches, discolorations, and sound pin knots shall be admitted. Bright sap and wormholes if filled or patched, shall be admitted.

71. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

SLICED—SAP GRADES

72. *Grade No. 1.*—Each face shall be of one or more pieces of veneer of random widths. Eighty-five percent of heart-grain character is permitted. Mineral discolorations shall be admitted. Sound pin knots are permitted if the average is not in excess of two for each

[5] Veneer sliced through the heart of the log and showing either or both striped- and heart-grain character in varying proportions.

square foot. Sap or black wood, in any quantities, shall be admitted. Wormholes, if inconspicuously filled or patched, shall be admitted.

73. *Grade No. 2.*—Each face shall be of one or more pieces of veneer of random widths, unselected for grain character or color, and with either striped- or heart-grain character in any proportion. Mismatches, discolorations, sound pin knots, and sap or black wood, in unlimited quantities, shall be admitted. Wormholes, if inconspicuously filled or patched, shall be admitted.

74. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

STRIPED [6]

75. *Grade A.*—Each face shall be of one or more pieces of veneer of random widths, and selected for uniform striped figure and color. Heart-grain character, not to exceed 10 percent, will be admitted. A few small inconspicuous pin knots shall be admitted. Bars, streaks, discolorations, sap, and wormholes shall not be admitted.

76. *Grade No. 1.*—Each face shall be of one or more pieces of veneer of random widths. Sound pin knots are permitted if the average is not in excess of two for each square foot. Mineral discolorations or heart grain, not in excess of 20 percent surface measure, shall be admitted. Bright sap, not to exceed 10 percent, and wormholes, if inconspicuously filled or patched, shall be admitted.

77. *Grade No. 2.*—Each face shall be from veneer of random widths. Heart-grain character not to exceed 30 percent, sap not to exceed 25 percent, mismatches, mineral discolorations, and pin knots shall be admitted. Wormholes, if filled or patched, shall be admitted.

78. *Grade No. 3.*—Faces and backs to be of quality described in paragraph 12.

STUMP

79. Veneer cut from walnut stumps showing either or both "grain-character" and "figure." The minumum figure required to meet the several grades is indicated below. Sap shall be admitted.

Minimum Figure Requires

Grade:	*Percentage of panel length*
A	75
No. 1	50
No. 2	25
No. 3	Grain figure.

BUTTERFLY- OR GRAIN-MATCHED DESIGN—PLAIN OR GRAIN CHARACTER

80. Well-matched walnut showing designs formed by grain character only. Sap shall be admitted.

CORES AND CROSSBANDING

81. The following paragraphs on cores and crossbandings describe the grades that shall be used when specially designated cores or crossbandings are required.

CORES OR CENTERS

SAWN

82. *Grade A (or Clear).*—A core of any designated wood with any specified type of tight-glued joint and random widths, full-length

[6] Veneer showing a striped- or ribbon-grain character. This veneer can be prepared and glued either with tight side out or booked for character matching. Book matching will be furnished unless otherwise specified.

strips not over 4 inches wide. Discolorations shall be admitted, but it shall be clear of defects.

83. *Grade No. 1 (or Regular).*—A core of any designated wood with any specified type of tight-glued joint and random widths, any one strip to be not over 4 inches wide. Sound knots, discolorations, and butt-joint strips, other than outer edges, shall be admitted. Open defects, if securely patched, shall be admitted.

84. *Grade No. 2 (or Clear Edge).*—A core of any designated wood in either "A" or "No. 1" grades, with edges clear of defects to permit shaping (or molding) to a depth of 1½ inches on all edges.

BANDED

85. *Banding.*—Bands to finish net width as specified, clear of any defect that may prevent required shaping (or molding). The purchaser may elect any suitable wood or woods for banded cores. Butt joints, unless otherwise specified, are permitted if tight. Standard width of bands shall be 2½ inches in the rough for plywood $^{13}/_{16}$ inch and thinner.

Any designated wood, B1E, banded one end.
Any designated wood, B2E, banded two ends.
Any designated wood, B1S, banded one side.
Any designated wood, B2S, banded two sides.
Any designated wood, B3, banded two ends and one side.
Any designated wood, B2S1E, banded two sides and one end.
Any designated wood, B4, banded two sides and two ends.

86. *Special banded cores.*—Mitered bands or any construction requiring bands other than those described above are to be considered special banded cores and complete details should appear in the specifications.

ROTARY CUT

87. *Grade No. 1.*—A core of any designated wood admitting two or more pieces of uniform thickness. No open joints permitted.

88. *Grade No. 2.*—A core of any wood admitting untaped joints and fractures, wormholes, open defects, splits, etc., without limit.

CROSSBANDING

89. *Grade No. 1.*—A crossbanding of any suitable wood admitting two or more pieces properly jointed and taped and clear of open defects throughout.

90. *Grade No. 2.*—A crossbanding of any wood admitting joints without limit.

TESTS

91. *Sampling.*—Samples for testing shall be taken from 1 percent of the panels in any shipment, but not less than 5 and not more than 10 panels shall be selected. A test specimen shall be cut from each end approximately at midwidth of the panel and from each edge approximately at midlength of the panel, while the fifth sample shall be taken from near the center of the panel.

92. *Tests for type 1 (high moisture resistance) bondage.*—Five samples each 1 by 3¼ inches shall be taken from each test panel and cut as illustrated in figure 2. They shall be submerged in water at room tem-

perature for a period of 16 hours and dried for 8 hours at a temperature of 145° F (plus or minus 5° F) and then followed by two cycles of soaking for 16 hours and drying for 8 hours under conditions described above. These samples shall then again be soaked for a period of 16 hours and tested, while wet, in a shear testing machine, as illustrated in figure 3, by placing them in the jaws of a device to which a load

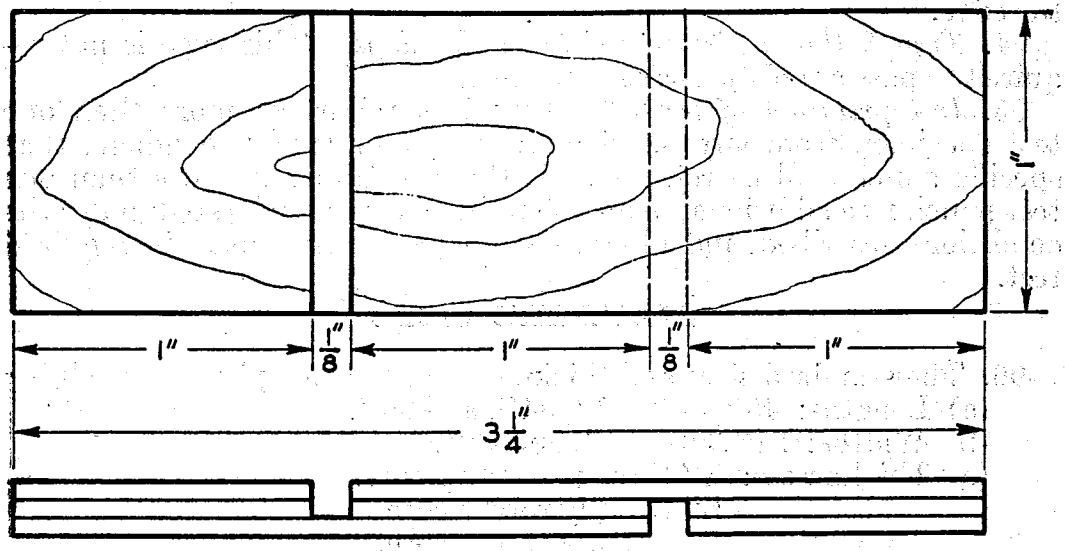


FIGURE 2.—*Test specimen.*

shall be applied at the rate of 600 to 1,000 pounds per minute, until failure. When the average strength of the samples selected for test is below 250 pounds per square inch, they must show not less than 25-percent minimum and 50-percent average wood failure. When the samples have an average strength ranging from 250 to 350 pounds per square inch, they must show not less than 10-percent minimum and

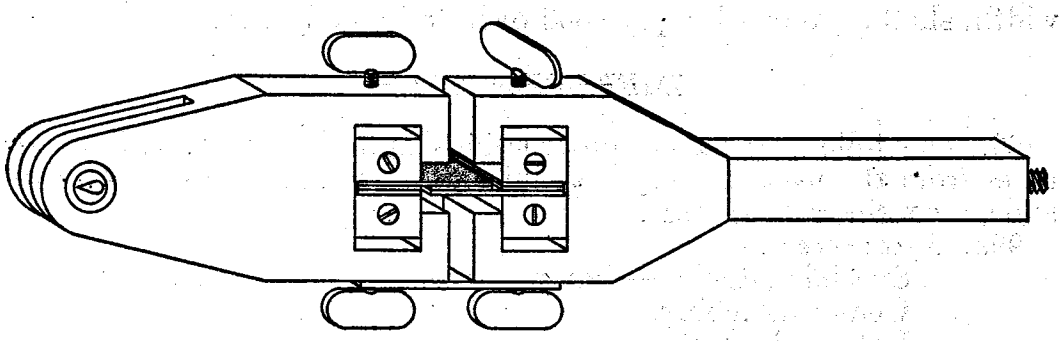


FIGURE 3.—*Jaws for shear test.*

30-percent average wood failure. When the samples have an average strength above 350 pounds per square inch, they must show not less than 10-percent minimum and 15-percent average wood failure. The test specimens must also show no separation of plies at the line of bondage during the soaking and drying cycles. If the number of plies exceeds three, the cuts shall be made so as to test any two of the joints, but at least one-half of the test shall include the innermost joints. The additional plies need not be stripped, except as demanded by the limitations of the width of the retaining jaws of the testing machine.

93. *Test for type 2 (moderate moisture resistance) bondage.*—Five samples 6 by 6 inches shall be taken from each test panel. The samples shall be submerged in water at room temperature for a period of 4 hours, followed by drying at a temperature not to exceed 100° F for a period of 20 hours. This cycle shall be repeated a second time, after which the samples must not show a delamination between any two layers of veneer greater than 2 inches, measured parallel to the edge.

94. *Type 3 (low moisture resistance) bondage.*—This type is not required to pass a moisture-resistance test.

95. *Interpretation of test.*—If there is a failure of more than one test specimen from any panel with type 1 or type 2 bondage, that specific panel shall be rejected. If there is failure in more than one test panel, five additional panels shall be selected and tested under the conditions described, and all of these five panels must pass the required test.

STANDARD SIZES

96. The standard sizes and thicknesses of finished plywood shall be:

(a) Lengths: 48″, 60″, 72″, 84″, and 96″.
(b) Widths: 24″, 30″, 36″, and 48″.
(c) Thicknesses: ¼″ three-ply rotary core.
⅜″ five-ply rotary core.
½″ five-ply rotary core.
$^{13}/_{16}$″ five-ply lumber core.

97. *Thickness.*—A tolerance of $^{1}/_{64}$ (0.016) inch, over or under the specified thickness, shall be allowed.

98. *Length and width.*—All commercial standard plywood shall be square within $^{1}/_{16}$ inch.

98a. A tolerance of $^{1}/_{32}$ inch, over or under the specified length and width, shall be allowed in plywood 48 by 36 inches or smaller.

98b. A tolerance of $^{1}/_{16}$ inch, over or under the specified length and width, shall be allowed in plywood over 48 by 36 inches.

DIFFERENTIALS

99. The following panel constructions and sizes represent departures from the usual factory schedules in the manufacture of plywood and are considered as extras.

99a. *Face veneers:*

Special matching—diamond, etc.
Center matching.
Balanced matching.
Matching in pairs.
Matching in sets.
Matching off-center.
Matching to detail or blueprint.
Special face designations—combination of various woods, etc.
Gluing of joints in face veneer.

99b. *Lumber cores, banded:*

(1) Area:

Group 1.—Any dimension of 8 or more square feet.
Group 2.—Any dimension of from 4 to 8 square feet.

Group 3.—Any dimension of from 1 to 4 square feet.
Group 4.—Any dimension of less than 1 square foot.

(2) Dimensions:
Lengths over 48 inches. Widths over 36 inches.

NOMENCLATURE AND DEFINITIONS

Banding (also referred to as "railing").—A portion of wood of any specified kind, extending around one or more sides of a piece of core, usually with its grain extending the long way. This banding of solid wood facilitates shaping the edges of the piece or may be finished flat to cover over the several colors presented in the end or side grain of the core.

Bands, cross.—(See Crossbanding).

Bird's-eye.—Bird's-eye is due to local sharp depressions in the annual rings, accompanied by considerable fiber distortion. Once the depressions are formed, succeeding growth rings follow the same contour for many years. In plain-sawed lumber and rotary veneer the depressions are cut through crosswise and show a series of circlets, portions of annual rings, suggesting rather remotely a bird's eye.

Blister figure.—Blister figure consists of seeming knoll-like elevations in the wood. It is due to an uneven contour of the annual rings, and not to blisters or pockets in the wood as the name might indicate.

Broken stripe.—Broken stripe is a modification of the stripe figure, due to undulations in the annual growth of the tree, which produce changes in the angle of the fibers.

Burl.—A type of figure produced by cutting through burls, which are wartlike protuberances on trees. They contain the dark pith centers of a large number of undeveloped buds.

Centers.—(See Cores.)

Centers, Banded.—(See Cores, banded.)

Chain figure.—A succession of short cross markings of uniform character remotely suggesting cross links of a chain.

Checks.—Small splits running parallel to the grain of the wood caused chiefly by strains produced in seasoning.

Cores.—Cores, sometimes also referred to as centers, are the innermost portions of plywood. They may be of sawn lumber, either one piece or several pieces joined and glued, or they may be of veneer.

Cores, Banded.—Cores that have been made with banding on one or more sides. (See banding).

Crossbanding.—Veneer used in the construction of plywood with five or more plies. In five-ply construction it is placed at right angles between the core and faces.

Cross-fire.—A distortion of the wood fibers of the tree which, cut the radial way, produce figures and highlights similar to a corrugated surface.

Crotchwood.—Highly figured veneer produced from that portion of a tree where two limbs unite.

Defects, open.—Checks, splits, open joints, cracks, loose knots, wormholes, or other defects interrupting the smooth continuity of the surface.

Doze.—A form of incipient decay characterized by a dull and lifeless appearance of the wood accompanied by a lack of strength and a softening of wood substance.

Figure.—Figure is the pattern formed by peculiar arrangement of the elements within the tree, and by reflected light caused by the peculiar arrangement of the wood fibers, and by the exposure of the medullary, rays. The various kinds of figure are known by many different terms such a bird's eye, burl, crotch, and blister.

Flake, broken.—A breaking or loosening of the flake (medullary ray) or quartered material, most frequent in oak.

Grain.—A rather loose term applied to the vertical elements of wood as it occurs in the living tree. Grain is perhaps most easily delineated in certain woods by the presence of annual layers of more densely aggregated cells or by groups of prominent vessels which form the well-known growth rings, and when these are severed, they may become quite pronounced and the effect produced is referred to as "grain."

Grain character.—The pattern produced by cutting through growth rings and exposing the layers of prominent vessels, thus producing a varying pattern. This pattern is most pronounced in lumber or veneer cut tangentially (flat sawn) or in rotary-cut veneers.

Grain, ruptured.—A condition of slight breaks in the veneer caused by irregular grain or improper cutting.

Half round.—A manner of cutting veneer to bring out certain beauty of figure accomplished in the same manner as rotary cutting, except that the piece being cut is secured to a "stay log," a device that permits the cutting of the log on a wider sweep than when mounted with its center secured in the lathe.

Hardwood.—A general term used to designate the lumber produced from broad-leafed or deciduous trees in opposition to the so-called softwoods, those produced by evergreen or coniferous trees.

Hairline.—A thin perceptible line usually showing at a joint.

Joints, open.—A joint in which the two adjacent pieces of veneer do not fit tightly together.

Knots.—Cross section of a branch or limb whose grain usually runs at right angles to that of the piece in which it occurs.

Knots, open.—Where a portion of the wood substance of the knot has dropped out or where cross checks have occurred to present an opening.

Knots, pin.—A sound knot less than ¼ inch in diameter.

Loose side.—See definition under "tight side."

Matching, reversed or swing.—The matching of a veneer face by turning alternate adjacent sheets end for end.

Matching, book.—Turning alternate adjacent sheets over.

Matching, slide or slip.—Laying adjacent sheets tight side up without turning.

Mismatches.—Parts of the panel in which the grain character or figure of adjacent portions of veneer do not come together symmetrically.

Patches.—Insertions of sound wood placed and glued into panels from which defective portions have been removed.

Plywood.—Hardwood plywood is wood engineered for beauty, strength, and economical application. It is the product resulting from three or more layers of veneer, usually laid with the grain of each piece at right angles to the one adjacent to it. Almost always an odd number of plies is used to secure balanced construction. The veneer is united under pressure with a bonding agent, making the joints as strong as, or stronger than, the wood itself.

Quartered.—A method of producing veneer by slicing or sawing to bring out certain figures, produced by the medullary or pith rays, which are especially conspicuous in oak. The log is flitched in several different ways to allow the cutting of the veneer in a radial direction.

Railing.—See banding.

Ribbon stripe.—This type of figure consists of alternating lighter and darker strips, running more or less the length of the sheet, and varying from less than ¼ of an inch to more than 1½ inches in width. It is pronounced only in quartered or nearly quartered material. It usually is due to differences in the reflection of light from adjacent layers of wood, cut from trees with interlocked grain.

Rope figure.—A succession of short cross-fire remotely suggesting the twist of a rope.

Rotary cut.—A manner of cutting veneer by which the entire log is centered in a lathe and turned against a broad cutting knife, which is set into the log at a slight angle.

Sap.—An abbreviated term for "sapwood," the lighter-colored wood substance occurring in the outer portion of the tree.

Sliced.—A manner of cutting veneer by which logs or sawn flitches are held securely in a slicing machine and thrust downward onto a large knife, which shears off the veneer in sheets.

Splits.—Separations of wood fiber running parallel with the grain.

Stain.—Any discoloration of the wood substance. Common veneer stains are often produced by the chemical action of the iron in the cutting knife with the tannic acid in the wood, and by the chemical action of glue.

Streaks, mineral.—Natural discolorations of the wood substance.

Stripe, broken.—(See Broken stripe.)

Stripe, ribbon.—(See Ribbon stripe.)

Swirls.—Irregular grain usually surrounding knots or crotches.

Tight side.—This term and its opposite, "loose side," are used to refer to veneer cut with a knife. The product as it is cut by the wedge-shaped or beveled knife may be curved, thus producing small ruptures on the convex side, known as the "loose side." The opposite surface, strained slightly in compression, but free from any ruptures, is known as the "tight side."

EFFECTIVE DATE

The standard is effective for new production from July 15, 1942.

STANDING COMMITTEE

The following individuals comprise the membership of the standing committee, which is to review, prior to circulation for acceptance, revisions proposed to keep the standard abreast of progress. Each organization nominated its own representative. Comment concerning the standard and suggestions for revision may be addressed to any member of the committee or to the Division of Trade Standards, National Bureau of Standards, which acts as secretary for the committee.

Manufacturers:

DAWSON ZAUG (chairman), American Plywood Corporation, New London, Wis.
N. M. WILLSON, Pearl City Plywood Co., Inc., Jamestown, N. Y.
W. F. DURBIN, Hoosier Panel Co., New Albany, Ind.
LAWRENCE OTTINGER, United States Plywood Corporation, Inc., 616 W. 46th Street, New York, N. Y.
G. S. LESTER, Algoma Plywood & Veneer Co., Algoma, Wis.
R. FAY KULMER, The Mengel Co., Louisville, Ky.

Distributors:

C. W. PERRY, P. O. Box 1346, High Point, N. C.
T. R. WILLIAMS, Ichabod T. Williams & Sons, 220 11th Avenue, New York, N. Y.
DON L. DAVIS, Aetna Plywood & Veneer, 1731 Elston Avenue, Chicago, Ill.
TED THOMPSON, Plywood-Detroit Co., Detroit, Mich. (Representing National Association of Plywood Distributors).

Users:

THEODORE I. COE, The American Institute of Architects, The Octagon, 1741 New York Avenue, Washington, D. C.
G. MELVIN HARLACKER, Pennsylvania Furniture Co., York, Pa.
A. P. HAAKE, National Association of Furniture Manufacturers, Inc., 666 Lake Shore Drive, Chicago, Ill.
ROSCOE R. RAU, National Retail Furniture Association, 666 Lake Shore Drive, Chicago, Ill.
WALTER JUNGE, Technical Division, Federal Housing Administration, Washington, D. C.
LT. E. L. KNUTSON, C. E., Engineering and Development Branch, Supply Division, Office of the Chief of Engineers, War Department, New War Department Bldg., Washington, D. C.

HISTORY OF PROJECT

Pursuant to a request from the Plywood Manufacturers Association, a general conference of manufacturers, distributors, and users of plywood, made from hardwoods and Eastern red cedar, was held in Chicago, Illinois, on April 9, 1931, to consider the adoption of standard grading rules for the guidance of the trade.

The proposed standard was thoroughly discussed, and, after several constructive changes were made, the conference recommended that it be circulated to the trade for written acceptance. Accordingly, the Recommended Standard was submitted to producers, distributors, and users under date of May 29, 1931. Following receipt of written acceptances from a satisfactory majority, the standard was announced on August 1, 1931, to become effective for new production on September 1, 1931.

FIRST REVISION

On February 6, 1942, the Hardwood Plywood Institute submitted a proposed revision which included requirements and tests for three types of adhesive bondage having a high, moderate, and low resistance to moisture, as well as a number of changes in the defects which are or are not permissible in the various species and grades. These changes were approved by the Standing Committee and the recommended revision was circulated on May 1, 1942, to those directly concerned, for written acceptance.

Following acceptance by a satisfactory majority, the success of the revision was announced on June 15, 1942.

ACCEPTANCE OF COMMERCIAL STANDARD

If acceptance has not previously been filed, this sheet properly filled in, signed, and returned will provide for the recording of your organization as an acceptor of this commercial standard.

Date _____

Division of Trade Standards,
National Bureau of Standards,
Washington, D. C.

Gentlemen:

Having considered the statements on the reverse side of this sheet, we accept the Commercial Standard CS35–42 as our standard of practice in the

Production [1] Distribution [1] Use [1] Testing [1]

of plywood (hardwood and Eastern red cedar).

We will assist in securing its general recognition and use, and will cooperate with the standing committee to effect revisions of the standard when necessary.

Signature of individual officer _____
(in ink)

(Kindly typewrite or print the following lines)

Name and title of above officer _____

Organization _____
(Fill in exactly as it should be listed)

Street address _____

City and State _____

(Cut on this line)

[1] Please designate which group you represent by drawing lines through the other three. Please file separate acceptances for all subsidiary companies and affiliates which should be listed separately as acceptors. In the case of related interests, trade papers, colleges, etc., desiring to record their general approval, the words "in principle" should be added after the signature.

TO THE ACCEPTOR

The following statements answer the usual questions arising in connection with the acceptance and its significance:

1. *Enforcement.*—Commercial standards are commodity specifications voluntarily established by mutual consent of those concerned. They present a common basis of understanding between the producer, distributor, and consumer and should not be confused with any plan of governmental regulation or control. The United States Department of Commerce has no regulatory power in the enforcement of their provisions, but since they represent the will of the interested groups as a whole, their provisions through usage soon become established as trade customs, and are made effective through incorporation into sales contracts by means of labels, invoices, and the like.

2. *The acceptor's responsibility.*—The purpose of commercial standards is to establish for specific commodities, nationally recognized grades or consumer criteria, and the benefits therefrom will be measurable in direct proportion to their general recognition and actual use. Instances will occur when it may be necessary to deviate from the standard, and the signing of an acceptance does not preclude such departures; however, such signature indicates an intention to follow the commercial standard where practicable, in the production, distribution, or consumption of the article in question.

3. *The Department's responsibility.*—The major function performed by the Department of Commerce in the voluntary establishment of commercial standards on a Nation-wide basis is fourfold: first, to act as an unbiased coordinator to bring all interested parties together for the mutually satisfactory adjustment of trade standards; second, to supply such assistance and advice as past experience with similar programs may suggest; third, to canvass and record the extent of acceptance and adherence to the standard on the part of producers, distributors, and users; and fourth, after acceptance, to publish and promulgate the standard for the information and guidance of buyers and sellers of the commodity.

4. *Announcement and promulgation.*—When the standard has been endorsed by a satisfactory majority of production or consumption in the absence of active, valid opposition, the success of the project is announced. If, however, in the opinion of the standing committee or the Department of Commerce, the support of any standard is inadequate, the right is reserved to withhold promulgation and publication.

ACCEPTORS

The organizations and individuals listed below have accepted these grading rules as their standard of practice in the production, distribution, and use of hardwood plywood. Such endorsement does not signify that they may not find it necessary to deviate from the standard, nor that producers so listed guarantee all of their products in this field to conform with the requirements of this standard. Therefore, specific evidence of conformity should be obtained where required.

ASSOCIATIONS

American Specification Institute, Chicago, Ill.
Carolina Lumber & Building Supply Association, Charlotte, N. C. (In principle.)
Chicago Lumber Institute, Chicago, Ill.
Douglas Fir Plywood Association, Tacoma, Wash. (In principle.)
Hardwood Plywood Institute, Chicago, Ill.
Mahogany Association, Chicago, Ill.
National Association of Funiture Manufacturers, Chicago, Ill.
National Association of Mutual Casualty Co's., Chicago, Ill. (In principle.)
National Hardwood Lumber Association, Chicago, Ill.
National Lumber Exporters Association, Memphis, Tenn.
National Oak Flooring Manufacturers Association, Memphis, Tenn.
National Plywood Distributors Association, Detroit, Mich.
Northeastern Lumber Manufacturers Association, Inc., New York, N. Y. (In principle.)
Southern Hardwood Producers, Inc., Memphis, Tenn. (In principle.)
Veneer Association, The, Chicago, Ill. (In principle.)
Wisconsin Retail Lumbermens Association, Milwaukee, Wis.

FIRMS

Adams, Franklin O., Tampa, Fla.
Adams & Kelly Co., Omaha, Nebr.
Adkins & Co., E. S. Salisbury, Md.
Aetna Plywood & Veneer, Chicago, Ill.
Algoma Plywood & Veneer Co., Algoma, Wis.
Altfillisch, Charles, Decorah, Iowa.
American Chair Co., Sheboygan, Wis.
American Forest Products Corporation, New York, N. Y.
American Furniture Co., The, Batesville, Ind.
American Houses, Inc., New York, N. Y.
American Plywood Corporation, New London, Wis.
American Seating Co., Grand Rapids, Mich.
American Specialty Corporation, Indianapolis, Ind.
Anchor Toy Corporation, Coudersport, Pa.
Andrews, Jones, Biscoe & Whitmore, Boston, Mass.
Angelus Furniture Manufacturing Co., Los Angeles, Calif.
Appleton & Co., Inc., Philadelphia, Pa.
Arcadia Furniture Co., Arcadia, Mich.
Arizona Sash, Door & Glass Co., Phoenix, Ariz.
Associated Plywood Mills, Olympia, Wash. (In principle.)
Atlanta Oak Flooring Co., Atlanta, Ga.
Auler, Jensen & Brown, Oshkosh, Wis.
Austell Cabinet Co., Austell, Ga.
Ayers-Cihlar-Ransome Co., Chicago, Ill.
Bakelite Corporation, New York, N. Y. (In principle.)
Balch & Lippert, Madison, Wis.
Baldwin Plywood & Veneer Co., Gillett, Wis.
Baltimore, Bureau of Plans & Surveys of, Baltimore, Md.
Baltimore Chair Co., Baltimore, Md.
Barthmaier, Eugene V., Philadelphia, Pa.
Bay View Furniture Co., Holland, Mich.
Beacham & LeGrand, Greenville, S. C.
Beecher Falls Manufacturing Corporation, Beecher Falls, Vt.
Behrend, Jacob, Philadelphia, Pa.
Bell Manufacturing Co., Inc., C. C., West Monroe, La.
Beuttler, William, Sioux City, Iowa.
Bickford, Robt. T., Elmira, N. Y.
Bishop, Horatio W., La Mesa, Calif.
Blair Veneer Co., North Troy, Vt.

Blake, Edgar Ovet, Evanston, Ill.
Blithe, Wesley Lesher, Philadelphia, Pa.
Blumer Cabinet Co., St. Louis, Mo.
Boehm, George A., New York, N. Y.
Bogner, Harry, Milwaukee, Wis.
Boston Mirror Co., Boston, Mass.
Bradford Veneer & Panel Co., Bradford, Vt.
Braseth & Houkom, Fargo, N. Dak.
Brazer, Clarence W., New York, N. Y.
Brew Manufacturing Co., Puyallup, Wash.
Brill Co., The J. G., Philadelphia, Pa.
Bristol Door & Lumber Co., Bristol, Tenn.
Bruce Co., E. L., Memphis, Tenn.
Brust & Brust, Milwaukee, Wis.
Bucky, Fred W., Jr., Jacksonville, Fla.
Budde & Weis Manufacturing Co., Jackson, Tenn.
Buechner & Orth, St. Paul, Minn. (In principle.)
Buell, Benning C., Buffalo, N. Y.
Buffelen Lumber & Manufacturing Co., Tacoma, Wash.
Building Service, Inc., Great Falls, Mont.
Burnham & Hammond, Chicago, Ill.
Burnside Veneer Co., Inc., Burnside, Ky. (In principle.)
Burritt Co., The A. W., Bridgeport, Conn.
California Panel & Veneer Co., Los Angeles, Calif.
Camfield Manufacturing Co., Grand Haven, Mich.
Camlet, J. Thomas, Passaic, N. J.
Candela, Rosario, New York, N. Y.
Cannon & Mullen, Salt Lake City, Utah.
Carolina Panel Co., Lexington, N. C.
Carpenter, Charles A., Rochester, N. Y.
Carroll, John, Ventnor, N. J.
Cavalier Corporation, Chattanooga, Tenn.
Cellarius, Chas. F., Cincinnati, Ohio.
Chapin, Rollin C., Minneapolis, Minn. (In principle.)
Charak Furniture Co., Boston, Mass.
Charles Manufacturing Co., Minneapolis, Minn.
Chattahoochee Furniture Co., Flowery Branch, Ga.
Chrysler Corporation, Highland Park, Mich.
Cleveland Window Glass & Door Co., Cleveland, Ohio.
Clore & Hawkins, Brightwood, Va.
Clune Co., Inc., M., Indianapolis, Ind.
Cocheo Bros., Inc., Weehawken, N. J.
Coit, E., New York, N. Y.
Collier-Barnett Co., The Toledo, Ohio.
Colonial Furniture Co., High Point, N. C.
Columbus Show Case Co., The, Columbus, Ohio.
Commercial Furniture Co., Chicago, Ill.
Conrad & Cummings, Binghamton, N. Y.
Conrow, H. S., Wichita, Kans.
Cook-Anderson Co., Beaver, Pa.
Coolidge, Shepley, Bulfinch & Abbott, Boston, Mass.
Corlett, Will G., Oakland, Calif. (In principle.)
Cram & Ferguson, Boston, Mass.
Crane Co., The Arthur D., Sparta, N. J.
Crawford Furniture Manufacturing Corporation, Jamestown, N. Y.
Crescent Panel Co., Inc., Louisville, Ky.
Crowell & Lancaster, Bangor, Maine.
Curtis Co's., Inc., Clinton, Iowa.
Curtis Co's., Inc., Wausau Division, Wausau, Wis.
Curtiss & Son, Wm. P., Richland, N. Y.
Cushman Manufacturing Co., H. T., North Bennington, Vt.
Davenport Cabinet Works, Inc., Davenport, Iowa.
Davis Furniture Corporation, Jamestown, N. Y.
Day & Todd, Rochester, N. Y.
De Jarnette, Charles Wagner, Des Moines, Iowa.
Deacon Co., J. C., Chicago, Ill.
Delehanty, Andrew L., Albany, N. Y.
Denny Roll & Panel Co., High Point, N. C.
Dietel, George J., Buffalo, N. Y.
District of Columbia, Government of, Office of the Municipal Architect, Washington, D. C.
Dodge & Morrison, New York, N. Y.
Drexel Furniture Co., Inc., Drexel, N. C.
Dryden, Allen N., Kingsport, Tenn.
Edison, Inc., Thomas A., West Orange, N. J.
Eggers Plywood & Veneer Co., F., Two Rivers, Wis.
Eichenlaub, Geo. E., Erie, Pa.
Eldridge, Charles Wm., Oswego, N. Y.
Elsasser, Frederick A., Union, N. J.
Emery Industries, Inc., Cincinnati, Ohio.
Empire Case Goods Co., Jamestown, N. Y.
Empire Furniture Corporation, Johnson City, Tenn.
Erdelen, Arthur F., St. Louis, Mo. (In principle.)
Estes Lumber Co., Birmingham, Ala.
Everett & Associates, H. F., Allentown, Pa.
Fairchild Aircraft, Hagerstown, Md. (In principle.)
Farley-Lootscher Co., Sioux Falls, S. Dak.
Farley & Loetscher Manufacturing Co., Dubuque, Iowa.
Faucett-Umphrey Corporation, Morgantown, Ind.

Fessenden Hall, Philadelphia, Pa.
Fetzer & Fetzer, Salt Lake City, Utah.
Fitch, H. L., Brownsville, Tex.
Flannagan, Eric G., Henderson, N. C.
Flint & Horner Co., Inc., New York, N. Y.
Florida, University of, Gainesville, Fla. (In principle.)
Foltz & Son, Herbert, Indianapolis, Ind.
Foreman Derrickson Veneer Co., Elizabeth City, N. C.
Foster & Kleiser Co., San Francisco, Calif.
Frants & Spence, Saginaw, Mich.
Friedrichs, H., San Francisco, Calif.
Frost Veneer & Plywood Co., Inc., Sheboygan, Wis.
Fry-Fulton Lumber Co., St. Louis, Mo.
Fuller & Son Lumber Co., G., Brighton, Mass.
Fullerton Furniture Factories, Fullerton, Pa.
Furer, Wm. C., Honolulu, Hawaii. (In principle.)
Fyles & Rice Co., Inc., Bethel, Vt.
Gaertner, Otto, Yonkers, N. Y.
Gale Sales Co., B. L., Wilson, N. Y.
Gall, Harry L. C., New York, N. Y.
Garber, F. W., Cincinnati, Ohio.
Glen Desks, Inc., Glen Rock, Pa.
Glen Manufacturing Co., Glen Rock, Pa.
Globe-Wernicke Co., The, Norwood, Ohio.
Gluedtite Panel Co., Cadillac, Mich.
Goshen Veneer Co., Goshen, Ind.
Greene Manufacturing Co., Inc., Greene, N. Y.
Greenville Army Flying School, Greenville, Miss.
Grobstein Construction Co., Lakewood, N. J.
Groffman, L. C., St. Louis, Mo. (In principle.)
Gunn Furniture Co., Grand Rapids, Mich.
Hahn, Stanley W., Silver Spring, Md.
Hale Co., Inc., East Arlington, Vt.
Hammond Instrument Co., Chicago, Ill.
Hannaford & Sons, Samuel, Cincinnati, Ohio.
Harbor Plywood Corporation, Hoquiam, Wash.
Harbor Plywood Corporation (Chicago Division), Chicago, Ill.
Harbor Plywood Corporation of California, San Francisco, Calif.
Harbor Plywood Corporation of Wisconsin, Milwaukee, Wis.
Hard Manufacturing Co., The, Buffalo, N. Y.
Hardwood Products Corporation, Neenah, Wis.
Harper Furniture Co., Lenoir, N. C.
Harper & West, Boston, Mass.
Hasness, Carlisle D., Harrisburg, Pa.
Haxby & Bissell, Minneapolis, Minn.
Hayden Co., The, New York, N. Y.
Heacock & Platt, Philadelphia, Pa.
Heidritter Lumber Corporation, Elizabeth, N. J.
Helfensteller, Hirsch & Watson, St. Louis, Mo.
Henrich Panel Co., Inc., Buffalo, N. Y.
Higgins, Charles H., New York, N. Y.
Hoener, P. John, St. Louis, Mo.
Holsman & Holsman, Chicago, Ill.
Hoosier Panel Co., The, New Albany, Ind.
Hope, Frank L., Jr., San Diego, Calif.
Hopkins, Albert Hart, Buffalo, N. Y.
Horley, Edward F., Ingram, Pa.
Huber-Lanctot Housewrecking Corporation, Buffalo, N. Y.
Hudson, Flynn E., Jr., Montgomery, Ala.
Huntingburg Furniture Co., Huntingburg, Ind.
Hyde-Murphy Co., Ridgway, Pa.
Ideal Desk Co., Auburn, Maine.
Illinois, University of, Department of Architecture, Urbana, Champaign, Ill. (In principle.)
Imperial Upholstering Co., Lowell, Mass.
Indiana Lumber & Supply Co., Inc., Indiana, Pa.
Indiana Veneer & Panel Co., New Albany, Ind.
Indianapolis Chair & Furniture Co., Aurora, Ind.
Institutional Furniture Co., Grand Rapids, Mich.
Ipik Plywood Corporation, Kenner, La.
Iron City Sash & Door Co., Pittsburgh, Pa.
Ivey, Inc., Edwin J., Seattle, Wash.
J. & S. Furniture Manufacturing Co., Chicago, Ill.
Jamestown Lounge Co., Jamestown, N. Y.
Jamestown-Royal Upholstery Corporation, Jamestown, N. Y.
Jamestown Table Co., Jamestown, N. Y.
Jamestown Veneer & Plywood Corporation, Jamestown, N. Y.
Jasper Desk Co., Jasper, Ind.
Jasper Wood Products Co., Jasper, Ind., and Watsontown, Pa.
Johnson-Carper Furniture Co., Inc., Roanoke, Va.
Johnstone, Harry Inge, Mobile, Ala.
Jokel-Coy-Thal, Toledo, Ohio.
Kahn, E. J., New York, N. Y.
Kansas State College, Manhattan, Kans.
Karcher & Smith, Philadelphia, Pa. (In principle.)
Karges Furniture Co., The, Evansville, Ind.
Karpen & Bros., S., Chicago, Ill.
Kaul Lumber Co., Birmingham, Ala.
Kearns Furniture Co., High Point, N. C.
Keely Plywood Co., Hal, Pittsburgh, Pa.

Keich & O'Brien, Warren, Ohio.
Kellogg & Sons Co., Charles C., Utica, N. Y.
Kelly Bros., Inc., Gardner, Mass.
Kilham, Hopkins & Greeley, Boston, Mass.
Kimball, Harry Smith, South Portland, Maine.
Kimball Co., W. W., Chicago, Ill.
Kittinger Co., Inc., Buffalo, N. Y.
Kohn, Robert D.,—Charles Butler, New York, N. Y.
Kramer, Plywoods & Hardwoods, John, New York, N. Y.
Krueger Manufacturing Co., The, Atlanta, Ga.
Kruse & Parish, Davenport, Iowa.
Kullberg Manufacturing Co., Minneapolis, Minn.
Kyle, Herbert S., Charleston, W. Va.
Lanphaer & Wade, Buffalo, N. Y.
Larrick, Thomas, Athens, Ohio.
Latenser & Sons, Inc., John, Omaha, Nebr.
Laurinburg Plywood Corporation, Laurinburg, N. C.
Law, Law & Potter, Madison, Wis.
Lawrence, Holford & Allyn, Portland, Oreg.
Lee Manufacturing Corporation, The, Canastota, N. Y.
Lentz Table Co., Nashville, Mich.
Levine, Ernest, New Brunswick, N. J. (In principle.)
Levy, Will, St. Louis, Mo.
Loeb, Laurence M., White Plains, N. Y.
Loetscher & Burch Manufacturing Co., Des Moines, Iowa.
Los Angeles, City of, Los Angeles, Calif.
Louisville Veneer Mills, The, Louisville, Ky.
Lynch & Foard, Wilmington, N. C.
Manten Lumber Co., The, Winchester, Mass.
Markland Contracting Co., M. B., Atlantic City, N. J.
Mason & Co., George D., Detroit, Mich.
Massena & du Pont, Inc., Wilmington, Del.
Mauk Seattle Lumber Co., Seattle, Wash.
Mauran, Russell, Crowell & Mullgardt, St. Louis, Mo.
Mell Lumber Co., Philadelphia, Pa.
Mengel Co., The, Louisville, Ky.
Merritt Engineering & Sales Co., Inc., Lockport, N. Y.
Mersman Bros. Corporation, The, Celina, Ohio.
Miller Furniture Co., Herman, Zeeland, Mich.
Miller & Yeager, Terre Haute, Ind.
Minneapolis Desk Manufacturing Co., Minneapolis, Minn.
Missouri Furniture Co., St. Louis, Mo.
Mock & Morrison, Tacoma, Wash.
Moore, J. W., New Orleans, La.
Mooser, William, San Francisco, Calif.
Morgan Millwork Co., Baltimore, Md.
Morgan, David H., Philadelphia, Pa.
Morgan Sash & Door Co., Oklahoma City, Okla.
Morrison-Merrill & Co., Salt Lake City, Utah.
Mueller, F. G., & W. R. Hair, Hamilton, Ohio.
Muhlenberg Bros., Reading, Pa.
Mundie, Jensen, Bourke & Havens, Chicago, Ill.
Myrtle Desk Co., High Point, N. C.
National Fixture Manufacturing Co., Inc., New Orleans, La.
National Plywood Co., Inc., New York, N. Y.
National Plywoods, Inc., Chicago, Ill.
Nebraska, University of, Lincoln, Nebr.
Nelson, Albert L., St. Louis, Mo.
Neumann & Sons, William, Jersey City, N. J.
Nevins, Inc., Henry B., City Island, New York, N. Y.
New Castle Products, New Castle, Ind.
New England Box Co., The, Greenfield, Mass.
New York Wood Working Corporation, New York, N. Y.
Newton Lumber Co., The, Pueblo, Colo.
Nicoll & Co., San Francisco, Calif.
Northern Furniture Co., Sheboygan, Wis.
Nurenburg, W. S., Ft. Worth, Tex.
Officer, Gwynn, Berkeley, Calif.
Olive & Myers Manufacturing Co., Dallas, Tex.
Overton Co., S. E., South Haven, Mich.
Pauk & Sons Manufacturing Co., St. Louis, Mo.
Pearl City Plywood Co., Inc., Jamestown, N. Y.
Peerless Built-In Fixture Co., Berkeley, Calif.
Pehrson, G. A., Spokane, Wash.
Pennsylvania State College, The, Department of Forestry, State College, Pa. (In principle.)
Pepper, George W., Jr., Philadelphia, Pa.
Perfect Parlor Furniture Co., Inc., Chicago, Ill.
Perlin Lumber Co., Brooklyn, N. Y.
Peterson Co., Cliff P., Minneapolis, Minn.
Phelps & Dewees & Simmans, San Antonio, Tex.
Phenix Furniture Co., Warren, Pa.
Phoenix Chair Co., Sheboygan, Wis.
Pierre & Wright, Indianapolis, Ind.
Pioneer Furniture & Mattress Co., Salt Lake City, Utah.
Piper, F. Stanley, Bellingham, Wash.
Pittsburgh Board of Public Education, Pittsburgh, Pa.
Platt & Bro., F. P., New York, N. Y.
Plywood Corporation, Boston, Mass.

Plywood Products Corporation, Bay City, Mich.
Plywoods-Plastics Corporation, Hampton, S. C.
Portland Furniture Manufacturing Co., Portland, Oreg. (In principle.)
Portsmouth Lumber Corporation, Portsmouth, Va.
Pratt Co., Amasa, Lowell, Mass.
Pulaski Veneer Corporation, Pulaski, Va.
Purves, Cope & Stewart, Philadelphia, Pa.
Quigley Furniture Co., Whitesboro, N. Y.
Ramsdell Co., L. B., Gardner, Mass.
Randolph Furniture Works, Jamestown, N. Y.
Red Lion Cabinet Co., Red Lion, Pa.
Red River Lumber Co., The, Westwood, Calif., New York, N. Y., Chicago, Ill., and other cities.
Reid, William H., Jr., Billings, Mont.
Reischmann Sons, Inc., New York, N. Y.
Resnikoff, Abraham, New York, N. Y.
Rieser Panel & Veneer Co., Inc., Arthur J., New York, N. Y.
Ring Furniture Co., Kernersville, N. C.
Ritchie & Associates, James H., Boston, Mass.
Ritter & Bro., Wm., Philadelphia, Pa.
Robert & Co., Inc., Atlanta, Ga.
Roberts Corporation, U. N., Davenport, Iowa.
Robertson Steel & Iron Co., Springfield, Ohio.
Rockford National Furniture Co., Rockford, Ill.
Rockford Republic Furniture Co., Rockford, Ill.
Rockwell Bros. & Co., Houston, Tex.
Rockwell Lumber Co., Houston, Tex.
Roddis Lumber & Veneer Co., Marshfield, Wis.
Rogers & Co., Charles P., Long Island City, N. Y.
Rounds & Porter Co., Wichita, Kans.
Saginaw Furniture Shops, Inc., Saginaw, Mich.
Saginaw, School District of the City of, Saginaw, Mich. (In principle.)
Schoeppe, Edward, Philadelphia, Pa.
Schulzke, William H., Moline, Ill.
Segelke & Kohlhaus Co., La Crosse, Wis.
Seidel Furniture Manufacturing Co., Inc., New Orleans, La.
Sellers & Sons Co., G. I., Elwood, Ind.
Setter Bros., Inc., Cattaraugus, N. Y.
Shanley, Geo. H., Great Falls, Mont.
Shaver, Chas. W., Salina, Kans.
Shaw, R. W., Enid, Okla.
Sheboygan Fruit Box Co., Sheboygan, Wis.
Shelbyville Desk Co., Shelbyville, Ind.
Sherman's Sons Co., R. A., Westerly, R. I.
Sieling Furniture Co., Railroad, Pa.
Southern Box & Lumber Co., Wilmington, N. C.
Southern California Telephone Co., Los Angeles, Calif.
Southwestern Veneer Co., Cotton Plant, Ark.
Space-Saving Furniture Co., New York, N. Y.
Specification Record, Chicago, Ill.
Spencer Cardinal Corporation, Marion, Ind.
Standard Furniture Co., Herkimer, N. Y.
Stark Co., James E., Memphis, Tenn.
Staub & Rather, Houston, Tex.
Stearns Lumber Co., The A. T., Neponset, Boston, Mass.
Steinmann, Robert, Cincinnati, Ohio.
Steul & Sons, Inc., Henry C., Buffalo, N. Y.
Steves Sash & Door Co., San Antonio, Tex.
Stewart Co., G. S., Norwalk, Ohio.
Stille & Duhlmeier Co., The, Cincinnati, Ohio.
Stoetzel, Ralph E., Chicago, Ill.
Stopper, Eugene A., Philadelphia, Pa.
Strable Hardwood Co., Oakland, Calif.
Streeter, D. D., Brooklyn, N. Y.
Suburban Millwork & Supply Co., Millburn, N. J.
Sweet's Catalog Service, New York, N. Y. (In principle.)
Taylor, Ellery K., Haddonfield, N. J.
Tekwood, Inc., Lakeport, N. H.
Temple, Seth J.—Arthur Temple, Davenport, Iowa. (In principle.)
Thomasville Chair Co., Thomasville, N. C.
Tiffin Manufacturing Co., The, Tiffin, Ohio.
Toledo Metal Furniture Co., The, Toledo, Ohio.
Torrey Veneer Co., F. S., Grand Rapids, Mich.
Trexler Lumber Co., Allentown, Pa.
Trogdon Furniture Co., Toccoa, Ga.
Twin City Hardwood Lumber Co., St. Paul, Minn.
Underwood Veneer Co., Wausau, Wis.
Union City Chair Co., Union City, Pa.
Union Furniture Co., Batesville, Ind.
United States Plywood Corporation, High Point, N. C., and New York, N. Y.
Valley Bedding Furniture Co., Fresno, Calif.
Van Pelt, John V., Patchogue, L. I., N. Y.
Vermont Furniture Manufacturing Co., Inc., Winooski, Vt.
Vermont Plywood, Inc., Hancock, Vt.
Villaume Box & Lumber Co., The, St. Paul, Minn.
Virginia Polytechnic Institute, Blacksburg, Va.